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Smoking Syndemics among a Sample of Men Who Have Sex with Men in Shanghai, China

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ABSTRACT

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Men who have sex with men (MSM) population are considerably at a greater risk for HIV infection in China. Studies in other countries indicated the prevalence of cigarette smoking among MSM is significantly higher than among their heterosexual peers. Western researchers found that MSM, gay, and/or bisexual men tend to experience more psychosocial problems, and have higher rates of substance use and HIV and other STIs. They proposed a syndemic theory to study the concurrent psychosocial conditions and health problems and their effects on HIV and other Sexually Transmitted Infections (STIs).

Guided by syndemic theory, we analyzed cigarette smoking in relation to demographics, substance use behaviors and psychosocial conditions among 404 MSM participants in Shanghai, China. We also aimed to explore the syndemic effects of substance use and psychosocial problems on sexual risks. Cross-sectional data were collected as part of larger study examining characteristics of HIV/STIs, sexual risks, and health issues among MSM. Bivariate logistic modeling suggests that MSM have a higher prevalence of smoking than general males in China. The smoking level is associated with alcohol and drug use, depression, intimate partner violence, sexual attitude and gay identity. Linear regression analyses present that substance use and psychosocial conditions could significantly predict sexual risks.

These findings are understood as part of a syndemic among MSM, and suggest that smoking prevention and cessation, as well as other substance abuse interventions should be integrated with the prevention of sexual risk behaviors for MSM in order for HIV and STIs prevention efforts to be more effective among MSM.

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INTRODUCTION

HIV Risk among Men Who Have Sex with Men in China

Although China is not experiencing a widespread AIDS epidemic (prevalence of less than 0.1% among adults) (1, 2), the incidence rate of AIDS has been rising sharply in recent years. In 2005, the Ministry of Health in China estimated that approximately 650,000 people were living with HIV/AIDS and the new infections were 70,000 in that year (3); in 2011, NCAIDS (National Center for AIDS/STD Control and Prevention) estimated that the number had increased to 780,000 (2). For the first time, HIV/AIDS was China's leading cause of death among infectious diseases in 2008 (4). The Ministry attributes 43.6% of the new cases to unprotected sex (3). In addition, recent data have shown that the risk of HIV infection has been more rapidly spreading in China's MSM (men who have sex with men) population. NCAIDS estimated that nearly one-third of the 780,000 HIV-infected people in 2009 were MSM, a significant increase from 12.2 percent in 2007 (5). A meta-analysis of 26 studies on prevalence of HIV infection and syphilis among MSM in China showed that the summary prevalence of HIV among Chinese MSM was 2.5% (95% CI: 0.9% to 3.3%), accompanied with a much higher prevalence of syphilis (9.1%) (6). Although the results of studies on HIV prevalence among MSM in China were frequently heterogeneous, it is obvious that Chinese MSM are considerably more affected by HIV compared to heterosexual men. Other researchers have also demonstrated that MSM and/or gay men are at greater risk for developing HIV and other STIs (Sexually Transmitted Infections) (7). However, most HIV/AIDS studies

in China still focus on single health problems, and too little research has been conducted on linking concurrent HIV-related health problems.

HIV-related syndemics in gay communities

Researchers in Western societies found that MSM, gay, and/or bisexual men tend to experience more psychosocial problems, such as depression, suicide, and partner violence, compared to their heterosexual counterparts (8-13). They also have higher rates of smoking, alcohol abuse and drug use, and are noted to have higher rates of HIV and other STIs (13-18). Due to the multiple co-occurring biosocial issues and problems in these sexual minority men, researchers have argued that these men are living in multiple “syndemics” (19, 20), including high rates of substance use and/or abuse, distress and depression, partner violence, attempted suicide, childhood sex abuse, and HIV/STI infections (20, 21). Syndemic refers to the concentration within a specific population of multiple co-occurring epidemics interacting and reinforcing one another and ultimately giving rise to other health problems (19).

A variant of the syndemic framework is the “Minority Stress Theory” (22, 23), which emphasizes that the minority stress, including social discrimination against MSM, gay, and/or bisexual men is associated with adverse health status, especially in mental health. These men, who are exposed to discrimination over time, are highly likely to develop stress, low self-esteem, and social isolation, which in turn compromise their health. Stall et al. proposed a theory of “syndemic production” of health disparities among gay men in the urban United States, linking high rates of depression, substance use and HIV/AIDS as

intertwined epidemics among groups of gay men that arise from negative childhood or adolescent experiences associated with their emergent gay identities (24-26).

Western researchers have applied the syndemic framework to HIV research among MSM, finding considerable empirical support for a model in which co-occurring health psychosocial problems, such as substance use, depression, and intimate partner violence (IPV), are mutually reinforcing, and function together to lower the health profile of gay men (8, 11, 27, 28). There is ample evidence of the interconnection of these issues among samples of adult gay and bisexual men during the HIV/AIDS epidemic (9, 16). For example, in their study of young men who have sex with men in New York City, Storholm et al. found that YMSM were more likely to report cigarette smoking, and smoking was related to the likelihood of using alcohol and a variety of illicit substances(29). In addition, YMSM who smoke reported a greater number of casual sex partners and transactional sex partners than non-smokers (29).

Cigarette smoking in China

Tobacco use is the second major cause of death (30), and the leading preventable cause of disease, disability and death in the world (31). Currently, smoking causes approximately 5 million deaths per year, accounting for one in ten deaths among adults worldwide (31). Nearly one-third of the world's smokers are living in China (32), a country as the largest producer and consumer of tobacco products in the world (33, 34). Tobacco use significantly increases the risks of many diseases among Chinese, for example, it significantly raises the risks of four major cancers (lung, esophagus, stomach and liver cancers) in China (32, 35-43), Chronic Obstructive Pulmonary Disease (COPD)

and respiratory tuberculosis (40), and vascular and heart diseases (36, 44, 45). Over one million deaths have been attributed to smoking annually, and mortality was estimated to reach 2 million by 2025 (38, 46). Together with its impact on health, smoking also increases the economic burden on a country. While the tobacco industry is profitable in China, the negative economic consequences for the country are undeniable. The total economic cost of smoking in China has increased from US \$17.1 billion to US \$28.9 billion between 2003 and 2008, accounting for 0.7% of China's GDP and 3.0% of total national health expenditures in 2008 (47).

Research in China has shown that smoking is significantly related to education, occupation, income, and legal residency (32). For example, the prevalence is lowest among those with at least a college education (54.2%) and highest among those with no more than primary schooling (72.4%) (32). More than 70% smokers are farmers, factory workers, service people, private company employees, self-employed, and the floating or itinerant population with no fixed residence (32). Other studies have suggested that smoking is more prevalent among populations with a lower income, and urban residents have significantly lower rates of smoking and number of cigarette consumed (48).

The most important feature of Chinese smokers is that the majority of them are adult males. The smoking prevalence is from 52.4% to 64% among males over 15 years old (31, 48-51), and 3.4% to 6.4% among females (49-51). Tobacco use also accounts for more than 50% of the sex difference in life expectancy (43). Due to the large population of male smokers, their tobacco use behaviors greatly affect the health of others, as most passive smoke is produced by male smokers. A survey indicated that in 2002, 82% of the

individuals exposed to passive smoking stated they had contact with a smoker at home (48).

Among the male smokers in China, some sub-groups need special attention. An important sub-group is men who have sex with men (MSM). Western and international literature has consistently documented higher prevalence of smoking among MSM and/or gay/bisexual men than their heterosexual counterparts (52, 53). However, the reach of Chinese government initiatives into the gay community was still limited, because of the disengagement with health authorities due to continued discrimination and fears of stigma (54). Only one study conducted in China described smoking and other substance-using behaviors among a sample of MSM in Shanghai, China (55). This study indicated that the smoking prevalence and number of cigarettes consumption are higher among MSM than adult males in general (55).

The health impact of cigarette smoking is not the only cause of concern with this special population. Western studies have demonstrated that smokers often have other substance use, such as alcohol abuse and multiple illicit drug use, which are associated with experience of having intimate partner violence, depression and a higher risk of HIV infection among MSM (16, 53, 56). In a study of gay and bisexual men in the United States, a significant association was found between cigarette smoking and HIV seroconversion among gay and bisexual men (53), providing further evidence of the relation between smoking and HIV and other STIs. Together, these studies suggest researchers apply a syndemic theory in tobacco and HIV-related research among MSM in China.

Guided by the syndemic framework, we aim to (1) identify and describe the psychosocial determinants for cigarette smoking among a sample of MSM in China; (2) compare the effects of the determinants (e.g., alcohol and drug use, depression, intimate partner violence, sexual attitude and gay identity) on the level of smoking; and (3) explore the syndemic effects of substance use and psychosocial problems on sexual risks.

METHODS

Data Source

The data used were part of a larger study examining characteristics of HIV/STIs, sexual risks, and health issues among MSM in Shanghai, China. Using a cross-sectional design, data were derived from Phases I of the study, collected between February and April 2009 using Respondent-driven Sampling (RDS) (57). Using RDS, a social network methodology to estimate population characteristics, 8 initial seeds (4 “money boys” and 4 general MSM) were selected based upon their self-identification as being a “money boy” (i.e., MSM who sell sex to other men) or general MSM (defined by a Chinese non-governmental organization). The seeds were then asked to recruit up to three peers each with US\$10 for a successful recruit, and the peers later recruit other participants using the same method. A payment of US\$40 was given for participation for the survey, which is sufficient and consistent with their effort, and does not present an undue amount by standard in China. They signed the consent forms to protect their confidentiality after they were informed of the nature and purpose of the study, survey procedures, the sensitive nature of questions, and confidentiality. The Emory University’s and Fudan

University's IRB (Institutional Review Board) both approved all protocols, consent, human subject forms and procedures underwent standard and rigorous translation and back-translation (Chinese-English-Chinese). In the dataset, all participants were de-identified. Four hundred and four eligible participants meeting the following criteria were enrolled in the study: (1) self-identified as a male; (17) aged 18 and above; (3) able to give verbal and written (in Mandarin) consent; and (4) had sex with a man in the last 12 months (oral, anal, or both). A de-identified dataset was used for data analysis.

Measures

Socio-demographic Characteristics. Participants were asked to report their demographic characteristics, such as date of birth, ethnicity (Han vs. other), occupation, education (illiterate to middle school, high school or equal, college or above), marital status (married and other), monthly income (<¥ 1000, ¥ 1000-2999.99, ¥ 3000-4999.99 or ≥ ¥ 5000), and Hukou (documented legal residency: Shanghai vs. other). They were also asked if they ever had sexual or intimate contact with another man and woman, and the age when they had the first contact. Sexual orientation was collected (openly gay or bisexual, closeted gay or bisexual, heterosexual or other), and they were asked to report if they had sex for money (general MSM and money boys).

Smoking Status and Level. All participants were asked if they had ever used cigarettes or tobacco. If participants indicated that they had, they were then asked for the number of cigarettes/tobacco products per day on average in the past three months. Two variables were created: (1) any smoking in the past three months versus no smoking; and

(17) non-smokers, light smokers (with less than 10 cigarettes per day (CPD)) and heavy smokers (with CPD equal to or more than 10).

Alcohol and Drug Use. Participants were asked for the number of alcoholic drinks (e.g., beer, wine, and liquors) per day in the past three months. For example, “Have you ever drunk yellow wine or rice wine?” If their response was “Yes”, then they would need to say how many bottles of that drink they consumed in the past week and in the past three months. The amount of alcohol use was coded into two levels: no alcohol use and alcohol use in the past three months. They were also asked for the use of any drugs (i.e., ecstasy, heroin, marijuana, opium, ice toxic, methamphetamine, cocaine, tranquilizers and stimulants) in the past three months, with questions such as “have you ever used ecstasy?” If they had ever used it, then they needed to answer how many times per day they used the drug on average in the past week and in past three months.

Depression. The “Center for Epidemiologic Studies Depression Scale” -- short form (CES-D) was used for depressive symptoms screening (58). Twelve items (e.g, “You had trouble keeping your mind on what you were doing”) were used to assess depressive symptoms by asking participants to indicate number of days in the past week when they had experienced the stated emotions or behaviors. Participants were asked to respond in a four-point format (0=rarely or none of the time (less than 1 day in past week), 3=most or all of the time (5-7 days in the past week)). The Cronbach’s Alpha of the short form CES-D scale was 0.85. A higher score indicated more depressive symptoms with the participant. The sum score of the depression items were calculated and a dichotomous

variable of depression were created: participants with a score higher than 10 were coded as depressive and a sum score lower or equal to 10 was coded as normal.

Intimate Partner Violence. A scale of intimate partner violence (IPV) was developed and used to screen for partner violence. Both verbal and physical violence were assessed. For example, participants were asked if their partners ever hit or threw something at them, or if they were verbally threatened. They were asked to respond “Yes” or “No” to these questions. The Cronbach’s Alpha of the IPV scale was 0.73. The total number of “Yes” questions was calculated as a sum score for IPV. A higher score indicated more times of experiencing intimate partner violence.

Lesbian, Gay, and Bisexual Identity Scale. The “Lesbian, Gay, and Bisexual Identity Scale” (LGBIS) was used to assess sexual orientation or gay identity. Participants were asked to rate 18 items such as “I prefer to keep my same-sex romantic relationships private” using a 7-point Likert format (1 = strongly disagree, 7 = strongly agree). The core domains of the Scale covers internalized homonegativity, the need for acceptance and privacy, identity confusion, and feelings of superiority. The Cronbach’s Alpha of LGBIS was 0.62. A higher scale score indicated more comfort with one’s gay identity, suggesting the participant was proud of being homosexual.

Sexual Attitudes. We assessed sexual attitudes using a scale of 23 questions, which covered three domains: permissiveness (ten items), birth control (three items), and instrumentality (five items). All items were rated on a 7-point Likert format (1 = disagree strongly, 7 = agree strongly). For example, participants were asked if they agreed with the statement “Casual sex is acceptable.” The Cronbach’s Alpha of the scale was 0.79. The

sum score of sexual attitudes was calculated and a higher score indicated more open attitude about sex.

Sexual Risk Behaviors. Eleven questions were developed to assess lifetime risk sexual experiences. The scale was developed from the HIV public health literature to reflect dimensions of sexual behaviors that have been found to increase the possibility of sexually transmitted infections. For example, participants were asked to report if they ever had unprotected sex practice with main sex partner/prostitute/casual partner. They were also asked if they ever had sex after drinking alcohol/using drugs, or had sex without a condom under the influence of alcohol/drugs. Options in all questions were dichotomous (0 = No and 1 =Yes) and the sum score (0-11) of the 11 items was calculated. The reliability of the scale was 0.62. The higher the sum score of sexual risk behaviors, the higher number of risky sexual practices that a participant experienced.

Analytic Strategies

The preliminary analyses were performed to describe the participants' socio-demographic characteristics, stratified by smoking status, i.e., non-smokers, light smokers and heavy smokers. The characteristics included age, Hukou, education, income, sexual orientation, participant type (general MSM vs. sex worker), and the age of first sexual contact with men and women. We consider age, Hukou, education and income based on previous published associations (32, 48, 59), and sexual orientation, participant type and the age of first sexual contract with men and women based on our selection of MSM as the target population. We used one-way ANOVA for statistical testing on continuous variables and chi-squares on categorical variables.

Several psycho-social variables that were found to be significantly associated with cigarette smoking were then entered into binary logistic regression analyses to determine if the psycho-social health problems were associated with cigarette smoking. Two sets of binary logistic regression were performed to determine the associations of independent variables with smoking, and if the associations were mediated by smoking levels.

To assess syndemics effects, the correlations between factors (substance use such as smoking, alcohol and drug use, and psychosocial conditions such as depression and IPV) and sexual risk behaviors were tested to determine if the factors were correlated to the outcome of interest. A linear regression model was constructed to explore if can be a cluster of psychosocial conditions will present a synergistic effect on sexual risks. In the second step, multiple substance use constructs were entered into the multivariable model to test if the seven predictors – including smoking status, alcohol use in three months, drug use, depression, sexual attitude, IPV, and gay identity – work together to produce a syndemic effects on sexual risk behaviors. SPSS 19 was used for data analysis.

RESULTS

Smoking in Relation to Demographic Characteristics

Of the 404 eligible participants, the prevalence of three-month smoking was approximately 66.3%, higher than that among the general Chinese males over 15 years old, which varied from 52.4% to 64% of the same age group (31, 49-51). One hundred and thirty-six participants were non-smokers, 108 were categorized as light smokers, and 160 were heavy smokers.

Table 1 summarizes the demographic characteristics of the sample. The participants had an average age of 29.7 years, and the majority of them were Han Chinese (96%), migrants to Shanghai (79.7%), received high school or higher education (63.2%), had a monthly income between 1000 to 4999 RMB (79.1%). The distribution of smoking varied by educational groups ($p=.001$), for example, 35.3% non-smokers, 19.4% light smokers, and 15.2% heavy smokers have college or higher education. Most participants were closeted gay/bisexual (79.5%), not married (85%), and about half of them were sex workers (49.5%). On average, they had the first sexual contact with men at 19.9 years old, and the first sexual contact with women at 20.4 years old.

Smoking in relation to other substance use and risk behaviors

Table 2 presents the results of binary logistic regression of demographics, alcohol use, drug use and psycho-social behaviors on smoking. In our sample, smoking was not associated with age. It was significantly associated with less than college level education, and participants with education of high school or equal level were more likely to engage in smoking than those with education of a lower level. Compared to alcohol users, participants who did not drink alcohol in the past three months were less likely to smoke. In particular, the results indicated the similar associations of specific alcohol types, such as beer, rice wine and Chinese. Drug use was also significantly related to smoking: participants who did not use drugs were less likely to smoke ($OR<1$). More participants with depressive symptoms engaged in smoking. In our sample, smoking was not related to the number of intimate partner violence which a participant experienced.

Overall, the predictors presented the same direction, but with different magnitude of an effect on predicting different levels of smoking. That is, the effects on heavy smokers were generally more extreme (further from 1). For example, compared to participants with college or higher education, those with high school education were more likely to be light smokers (OR=2.39, $p<0.05$), but were even more likely to be heavy smokers (OR=3.07, $p<0.001$). Similarly, compared to drug users, participants who never used drugs were less associated with light smoking (OR=0.47, $p<0.05$), and they were even less likely to be heavy smokers (OR=0.36, $p<0.01$). The effects on light smokers were moderate compared to that on heavy smokers, indicating a syndemic effect of those demographic, substance use and psychosocial factors on the level of smoking.

Substance use and psychosocial conditions in relation to sexual risk behaviors

Table 3 presents that there were significant correlations between substance use, psycho-social conditions and sexual risk behaviors. Sexual risks were highly significantly correlated with smoking ($p<0.01$), alcohol use ($p<0.01$), drug use ($p<0.01$), sexual attitude ($p<0.01$), Intimate Partner Violence ($p<0.01$) and gay identity (LGIS, $p<0.05$). In this sample, depression was not correlated with sexual risks. In the linear regression model predicting sexual risks in Table 4, the first step regression by four psychosocial conditions could predict sexual risks. Sexual attitudes ($p<0.001$), IPV ($p<0.001$), and gay identity ($p<0.01$) were highly significant predictors of sexual risk behaviors. After entering behavioral factors such as smoking, alcohol and drug use in the second step, all substance use and psychosocial conditions were significantly associated with sexual risks except depression. Cigarette smoking, alcohol and drug use, and the

experience of partner violence were significantly associated with odds of engaging more sexual risk behaviors. In contrast, more open attitude about sex and being more comfortable with one's gay identity were associated with less sexual risks.

DISCUSSION

The findings of the current investigation are consistent with previous studies in Western countries, indicating high prevalence of cigarette smoking among MSM. It identifies and describes the associations between smoking and other correlated health conditions. Using the Respondent-Driven Sampling method, all the participants of the “hidden” MSM population were recruited from Shanghai, so they may have similar demographic characteristics, such as similar levels of education and income, which limited participants from various backgrounds. Therefore, smoking did not appear significantly associated with age, income, which differ from previous surveys with larger samples in multiple locations (51, 60). The strong association between education level and smoking is consistent with previous research in China, suggesting the importance of health intervention on MSM smokers with lower education. Smokers were more depressed and more likely to engage in alcohol and drug use. Although we did not formally test for a dose-response effect, the point estimates for associations between psychosocial conditions and cigarette smoking suggested that heavy smokers might be more likely than light smokers to drink alcohol, use drugs, and feel more comfortable with their gay identity and more open about sex. This evidence conceptualized the health conditions or risk problem behaviors as constellation of health problems, indicating

involvement in one behavior/condition increased the likelihood of involvement in other risk behaviors because of social linkages and opportunities to practice them with other MSM.

Furthermore, the current study provides evidence for the association between cigarette smoking and sexual behavioral risks for HIV and other STIs. Combining tobacco use with other predictors, it suggests that cigarette smoking is part of a syndemic framework among MSM in China, and the population is at a greater risk for sexual risk behaviors. The psychosocial factors have an impact on participation in risky sex practices, and can synergistically work together with co-occurring substance use behaviors to affect sexual risk. For example, intimate partner violence such as forced sex directly confers the likelihood of exposure to HIV/STI transmission, and indirectly leads to HIV risk by contributing to mental health problems and substance use, increasing the likelihood for sexual risk behaviors. In addition, there is evidence that acceptance of a gay identity and successful integration into a gay community can serve to buffer some of the negative effects of stigmatization and lead to adopting safer sex practices (61-63). The conceptual model illustrated an expectation that psychosocial functioning and substance use or abuse would play a central role in the overall understanding of men's involvement in risky sex.

The findings suggest cigarette smoking or other substance use can be used as one easily identifiable indicator of MSM who are also likely to be at risk of unprotected sexual behavior under the influence of alcohol and drug, and negative psychosocial conditions. According to the syndemics theory, the synergistic effects of those health

conditions will influence the risk-taking behaviors of MSM on sexual practices. Thus, in order for HIV and STIs prevention efforts to be more effective among MSM, smoking prevention and cessation, as well as other substance abuse interventions should be integrated with the prevention of sexual risk behaviors for MSM. Health interventions addressing multiple problems could be more effective.

The study also suggests that future HIV prevention research in MSM focuses on a more comprehensive level, addressing multiple factors - such as HIV/STIs and health, mental health, sex behavior, drug use, and cigarette smoking - instead of studying those factors individually. These factors can overlap, and often present a systematic pattern that places MSM and gay men at a greater risk for health disparities and HIV infection. Further research is warranted to examine how substance use behaviors interact with psychosocial functioning and condom use to affect HIV risk practices.

The syndemics approach is also likely to apply to other minority population, such as lesbians. Further research is necessary to explore the effects of such multiple stigmatizations.

Strength and Limitations

This study is one of the few to examine smoking prevalence and apply the syndemic theory in HIV research among MSM in China. With its adequate sample size, this study can serve as a building block for further investigation. Using a Respondent-Driven Sampling method to locate and recruit members of a hidden population, the strength of

the study over other snow-ball sampling is that it reduces recruitment bias associated with the over-representation of those participants with large networks (64).

Our study relied on self-reported measures of both exposure and outcome variables, and results may be subject to measurement error or misclassification biases, for example, misclassified nonsmokers may have elevated serum cotinine levels (65, 66). Therefore, the results may underestimate the prevalence of smoking. In addition, the scale of sexual risk behaviors in this study was limited to condom use and sex with casual sex partners/prostitutes, and thus the conclusion cannot be generalized to other sexual risks.

We undertook an exploratory analysis and conducted binary logistic and linear regression tests to describe the levels of association between cigarette smoking and other risk behaviors. Using a cross-sectional study, the significant results cannot imply causality. Our data provide evidence that multiple health conditions synergistically affect risky behaviors in MSM in China. However, the current exploratory study did not assess interactions among the exposures, such as the interaction between smoking and alcohol. Lacking sufficient data of testing results of HIV and other STIs, the analyses can only explore the relationships between predictors and sexual risk behaviors, but not the direct association of predictors with the health outcome.

Finally, the study only recruited MSM and/or gay men from Shanghai and used a RDS method to recruit participants. We analyzed the data as a convenience sample, and did not use network sizes to weight the sample data to compensate for the over-sampling of participants who have larger average network sizes and more recruitment paths (67). Therefore, our data cannot be generalized to all MSM.

Conclusion

Chinese MSM and/or gay men have a higher prevalence of smoking compared to males in general, and the level of smoking is influenced by multiple factors, such as alcohol and drug use, depression and intimate partner violence. The adverse behaviors and psychosocial conditions work together to lower their sexual health status. Our data provide evidence that multiple factors synergistically affect risky behavior in MSM. It is likely that comprehensive HIV intervention may be more effective by addressing several syndemic problems. Further research is necessary for a more clear understanding of how those factors interrelate and affect risk taking behaviors among MSM.

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TABLES

Table 1: Demographic Characteristics of 404 MSM by Cigarette Smoking Status Recruited by Respondent-Driven Sampling Method in Shanghai Mens Study in Shanghai China, 2008-2009

| Characteristics | Nonsmoker (n=136) | Light Smoker (n=108) | Heavy Smoker (n=160) | P-Value |
|---|----------------------|----------------------------|----------------------------|---------|
| | | <u>Mean (SD)</u> | | |
| Age (years) | 29.4 (10.8) | 28.2(9.6) | 30.8(10.5) | 0.13 |
| Age when had the first sexual contact with men (years) | 20.2(5.9) | 19.1(5.3) | 20.2(6.7) | 0.29 |
| Age when had the first sexual contact with women (years) | 21.0(5.2) | 19.9(4.0) | 20.3(4.4) | 0.25 |
| | | <u>n (%)</u> | | |
| Ethnicity | | | | |
| Han | 133 (97.8) | 101(95.3) | 152(95.0) | 0.43 |
| Other ethnicities | 3 (2.2) | 5(4.7) | 8(5.0) | |
| Hukuo | | | | |
| Shanghai | 31 (22.8) | 15(13.9) | 36(22.5) | 0.15 |
| Other | 105 (77.2) | 93(86.1) | 124(77.5) | |
| Education | | | | |
| Illiterate to middle school | 43 (31.6) | 40(37.0) | 65(41.1) | 0.001 |
| High school or equal | 45 (33.1) | 47(43.5) | 69(43.7) | |
| College or above | 48 (35.3) | 21(19.4) | 24(15.2) | |
| Income (Yuan) | | | | |
| < 1000 | 14 (10.3) | 5(4.7) | 6(3.8) | 0.27 |
| 1000-2999 | 61 (44.9) | 56(52.3) | 87(54.4) | |
| 3000-4999 | 40 (29.4) | 29(27.1) | 46(28.8) | |
| ≥ 5000 | 21 (15.4) | 17(15.9) | 21(13.1) | |
| Sexual orientation | | | | |
| Openly gay / bisexual | 19 (14.0) | 6(5.6) | 24(15.0) | 0.13 |
| Closeted gay / bisexual | 108 (79.4) | 90(83.3) | 123(76.9) | |
| Other | 9 (6.6) | 12(11.1) | 13(8.1) | |
| Participant type | | | | |
| Sex worker | 60 (44.1) | 63(58.3) | 77(48.1) | 0.08 |
| General MSM | 76 (55.9) | 45(41.7) | 83(51.9) | |

Table 1: Continued

| Characteristics | Nonsmoker (n=136) | Light Smoker (n=108) | Heavy Smoker (n=160) | P-Value |
|-----------------------|----------------------|-------------------------|-------------------------|---------|
| | <u>n (%)</u> | | | |
| Marital status | | | | |
| Married | 24 (17.9) | 11(10.3) | 25(15.6) | 0.25 |
| Other | 110 (82.1) | 96(89.7) | 135(84.4) | |

Table 2. The Association Between Demographic, Behavioral and Psychosocial Predictors by Smoker Type among 404 MSM Recruited by Respondent-Driven Sampling Method in Shanghai Mens Study, in Shanghai, China, 2008-2009

| Predictors | Heavy smoking | | Light smoking | |
|-----------------------------------|---------------|---------------|---------------|---------------|
| | OR | (95% CI) | OR | (95% CI) |
| Age | 1.01 | (0.99 - 1.04) | 0.99 | (0.96 - 1.01) |
| Education | | | | |
| College+ | 1.00 | (referent) | 1.00 | (referent) |
| Illiterate-middle school | 3.02*** | (1.62 - 5.64) | 2.13* | (1.09 - 4.15) |
| High school or equivalent | 3.07*** | (1.65 - 5.67) | 2.39** | (1.24 - 4.60) |
| Alcohol in 3 months | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.32* | (0.13 - 0.83) | 0.34* | (0.12 - 0.92) |
| Beer in 3 months | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.40*** | (0.25 - 0.65) | 0.33*** | (0.19 - 0.57) |
| Rice wine in 3 months | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.39** | (0.20 - 0.73) | 0.71 | (0.34 - 1.52) |
| Chinese wine in 3 months | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.42* | (0.19 - 0.95) | 0.69 | (0.27 - 1.78) |
| Have you ever use drugs? | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.36** | (0.18 - 0.72) | 0.47* | (0.22 - 0.98) |
| Have you ever use ecstasy? | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.30* | (0.11 - 0.84) | 0.42 | (0.14 - 1.30) |
| Depression | | | | |
| Yes | 1.00 | (referent) | 1.00 | (referent) |
| No | 0.54** | (0.34 - 0.86) | 0.56* | (0.34 - 0.94) |
| Intimate Partner Violence | 1.13 | (0.95 - 1.33) | 1.01 | (0.84 - 1.23) |
| Sexual Attitude | 0.98*** | (0.96 - 0.99) | 0.99 | (0.98 - 1.01) |
| Gay Identity | 1.29 | (0.94 - 1.77) | 1.98*** | (1.37 - 2.87) |

* Significant at an alpha level = 0.05.

** Significant at an alpha level = 0.01.

*** Significant at an alpha level = 0.001.

Table 3. Correlation matrix between Sex Risk Behaviors and Factors among 404 MSM Recruited by Respondent-Driven Sampling Method in Shanghai Mens Study, in Shanghai, China, 2008-2009

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------------------|---|-------|-------|-------|------|--------|--------|--------|
| 1=Sex Risk Behaviors | 1 | .17** | .25** | .23** | 0.08 | -.17** | .21** | -.11* |
| 2=Cigarette smoking | | 1 | .12* | .15** | .13* | -.17** | 0.07 | 0.07 |
| 3=Alcohol use | | | 1 | .21** | .10* | -0.02 | .14** | -0.01 |
| 4=Life-time drug use | | | | 1 | 0.05 | 0.08 | 0 | -0.04 |
| 5=Depression | | | | | 1 | -0.04 | .136** | .22** |
| 6=Sexual attitude | | | | | | 1 | -0.018 | -.18** |
| 7=Intimate Partner Violence | | | | | | | 1 | -0.04 |
| 8=Gay identity | | | | | | | | 1 |

* Significant at an alpha level = 0.05.

** Significant at an alpha level = 0.01.

Table 4. Linear Regression on Sex Risk Behaviors among 404 MSM Recruited by Respondent-Driven Sampling Method in Shanghai Mens Study, in Shanghai, China, 2008-2009.

| Predictors | Life-time Sex Risk Behaviors | | |
|-------------------------------|------------------------------|-------------------------|----------------|
| | OR in Step ¹ | OR in Step ² | R ² |
| Depression | 0.03 | 0.02 | 0.10 |
| Sexual attitude | -0.02*** | -0.02*** | |
| Intimate Partner Violence | 0.28*** | 0.24*** | |
| Gay Identity (LGBIS) | -0.44** | -0.41** | 0.19 |
| Cigarette smoking in 3 months | | 0.23* | |
| Alcohol use in 3 months | | 1.16*** | |
| Life-time Drug use | | 1.04*** | |

* Significant at an alpha level = 0.05.

** Significant at an alpha level = 0.01.

*** Significant at an alpha level = 0.001.